

bricks and encaustic tiles manufactured from the clinker, and some interesting figures as to the strength of these materials were also given.

Another paper by a Yorkshire engineer, Mr. E. K. Clark, dealt with the subject of the shop buildings in large engineering works. The author had collected a large amount of statistics and figures, both as to the method of construction now generally adopted—viz., the shops all on one level—and as to the materials commonly used in their construction, and the paper will form a very valuable reference for any engineer engaged either in laying out new engineering workshops, or in reconstructing old buildings.

Mr. Glass contributed a lengthy paper dealing with the coal and iron ore fields of Shansi and Honan, and railway construction in China. The author was engaged in 1898 by a syndicate to proceed to China, and to examine and make a complete report on the coal and iron-ore fields of these two important provinces of China, and also to make surveys for the railways which it would be necessary to construct in order to utilise these deposits.

An interesting description was given of the general features of the country, illustrated by some beautiful lantern slides from photographs taken by the author, and also a very complete account of the Chinese method of working these mineral deposits. The author stated that it was somewhat difficult to arrive at very exact estimates of the quantity of coal available in these great fields, but it is believed there are more than 33,000 square miles of coal-fields in Shansi alone, and that the present output of Great Britain, which is more than 200 million tons a year, could be maintained from the anthracite coal-fields of Eastern Shansi alone for a period of 3000 years.

Samples of the coal have been analysed and show that it is a good steam coal.

Similar favourable accounts were given in regard to the iron ore deposits, and the author computed that it would be possible to produce a ton of pig-iron from these ores at the very low cost of 12s. 1½d. per ton, assuming labour to be at the same rate as it is now at Middlesbrough in England. The lowest price at which the pig-iron was being sold at the foundries visited by the author was a little over 20s. per ton.

The extraordinary richness of these mineral deposits and the enormous area awaiting development show how pressing the problem of reorganising peacefully the internal government of China is for the civilised world.

On the day devoted to electrical engineering, two short communications were read by Sir Wm. Preece and Mr. F. J. Behr, dealing with the proposed Monorail High Speed Electric Line between Manchester and Liverpool.

It will be remembered this scheme came before Parliament last session and was rejected, largely owing to the strenuous opposition of the existing railways.

The interesting feature in these papers was the account given of the brakes and signals which it is proposed to adopt, which must be an important matter on a line where it is proposed to run the trains at frequent intervals, and at such an excessively high speed as 110 miles per hour. Perhaps if the promoters had been content to reduce the proposed speed somewhat at the beginning, their scheme might have been more favourably considered.

A valuable paper dealt with on this day was one on the measurement of the tractive force, resistance and acceleration of trains, by Mr. A. Mallock. The author described the apparatus which he used for the purpose, and gave an account of some experiments which he has recently carried out on these important questions. He concluded from his results that pendulum observations combined with a record of speed and power offer a simple and effective means of determining the resistance to and efficiency of electric or other kinds of motor vehicles.

On this day also, a communication from Mr. W. T. E. Binnie, a son of the president, was read, describing a new form of self-registering rain-gauge which he has invented. The accuracy of the gauge depends on the fact that all drops falling from a tube are of constant size, provided that the tube is either very small so that the water passing down the interior chokes the bore, or that some special device is provided to spread out the water so as to wet the entire circumference of the tube. If, therefore, the weight of each drop were ascertained, it is clear that a measure of the amount of water passing down the tube would be obtained by counting the number of drops, and the electrical appliances are concerned with this part of the work.

An instrument made on this principle has been in operation for some time, and the records obtained from it in a period of five months give a total excess of 1·6 per cent. over the register of an ordinary rain-gauge.

Mr. W. Dawson contributed a paper descriptive of the Demerbe system of tramway construction, a system which has been tried on the Bradford Corporation tramways and found very successful in the reduction of the cost of permanent way repairs. In the Demerbe system the rail consists of a hollow trough and the fish plate is placed inside under the ends of the rails and exactly fits its contour, the fish-plate being forced into close contact with the under side of the rail by driving in two cotters. The rail, when laid in position, is completely filled, by means of specially-designed tools, with concrete. The tie bars are flat and very simply arranged, and the gauging of the rails can, therefore, be done rapidly with almost mathematical exactitude.

The system certainly seems to have considerable merits compared to the girder system of tram rails.

Two other instruments described in short communications were a combination integrating wattmeter and maximum demand indicator, the invention of Mr. J. H. Barker and Prof. Ewing, and a new form of calorimeter for measuring the wetness of steam, designed by Prof. Goodman.

The former instrument is designed to measure two quantities, the total amount of electricity used by a consumer and the maximum number of lamps or their equivalent ever lighted at one time. By this means it is possible to grade the charges for electric energy, and it enables the consumer to be charged at a lower rate for current he may use over and above the units which would have been used had the largest number of lamps in his installation burnt for one hour every day during the whole period the current was in use.

Prof. Goodman's instrument is intended to get over some of the more serious difficulties in measuring the wetness of steam supplied by any boiler. He discards entirely the wire-drawing system, and determines the wetness by condensing a known weight of the mixed steam and water in a known weight of cold water, and measuring the rise of temperature.

Prof. Beaumont, of Leeds, in a most interesting paper described the photographic method of preparing textile designs due to Szczepanik, a number of designs being shown which had been produced by this process.

In continuation of a paper which was read before the Association at Liverpool in 1896, Mr. A. T. Walmisley gave further information as to the use of expanded metal in concrete work, and gave particulars of a number of important tests which have been carried out to determine the increase of strength and the adhesion between the concrete and the metal.

The attendance at the sectional meetings was very good, and the president, Sir Alexander Binnie, may be congratulated on a successful and useful meeting.

#### BOTANY AT THE BRITISH ASSOCIATION.

IN the absence of Prof. Vines the presidential address was read by Dr. D. H. Scott. On the motion of Prof. Bayley Balfour, supported by Prof. Marshall Ward, Prof. Bower and other speakers, it was unanimously agreed to ask the Recorder of the Section to convey to Prof. Vines the sincere regret of the Botanists that he was prevented by illness from presiding over their meeting.

The customary semi-popular lecture was this year delivered by Prof. Percy Groom, who chose for his subject "Plant-form in relation to nutrition."

On Monday, September 10, the Section of Geology joined Section K in a discussion on the conditions under which the plants of the Coal Period grew. The discussion was opened by Mr. Kidston (Stirling), who gave a general account of the flora of the Coal-measures, illustrated by a series of excellent photographs of the various types of Upper Carboniferous plants. Mr. Seward dealt with the botanical evidence bearing on the climatic and other physical conditions under which coal was formed. On the geological side the discussion was opened by Mr. Strahan and Mr. Marr. Dr. Horace Brown discussed the question of the possible richness in CO<sub>2</sub> of the coal period atmosphere, and gave an account of some of his recent experiments with plants grown in an atmosphere containing twice or thrice the present amount of carbonic acid gas. Dr. Scott, Dr. Blackman, and Prof. Hartog also took part in the discussion from the botanical standpoint.

## GENERAL.

Prof. Bower, F.R.S., gave an account, illustrated by several excellent photographs, of sand-binding plant as seen in the dunes on the Scotch coast in the neighbourhood of North Berwick.

British sylviculture, by Samuel Margerison. In this communication attention was called to the large importation of foreign timber, and the urgent need of Government aid in the production of British timber. The author spoke of the existence of much land in this country at present unproductive, or only slightly productive, which is suitable for giving a native supply of timber. He compared the results of Continental and British sylviculture, and pointed out that in Britain the natural conditions are not less favourable, but the management is generally inferior. The author urged the importance of encouraging forestry schools which should afford opportunities for detailed research and teaching, with equipment, scientific and practical, worthy of the subject.

The great smoke-cloud of the North of England and its influence on plants, by Albert Wilson. The author spoke of the extent of the great smoke-producing district of the North of England and the miserable condition of the vegetation in some parts of the area. Among the various points dealt with in the paper, the following may be mentioned, the long distance reached by the smoke of large towns; the discoloration of rain-water ("black rain"); the effect of smoke on mosses and hepatics as compared with that on higher plants; the threatened extinction of *Ulotia* and *Orthotricha*; the influence of smoke on sunshine and air-temperature in calm summer weather and in anti-cyclonic weather during autumn or winter.

Embryonic tissues, by Prof. Marshall Ward, F.R.S. The author urged the advisability of improving the current terminology with regard to the nature and growth of the tissues termed embryonic. Sachs termed all the tissues of the growing-points, cambium, pericycle, &c., embryonic tissues. Prof. Ward would restrict the term *embryonic tissue* to that of the embryo alone before the desmogen strands are developed, the other tissues being designated *derived* or *secondary tissues*. The tissues of the growing-points are derived from embryonic tissue, and differ from it in that, instead of being capable of developing all or any part of the plant, they are more or less restricted to the power of developing shoots, leaves, &c., or only roots. The proposed classification would apply equally to the lower organisms; some of the Algæ and Schizomycetes appear to be always in the embryonic stage. Prof. Ward also urged the desirability of distinguishing between the *assimilatory* growth of true embryonic tissues and the *vacuolar growth* of the derived tissues.

## PHYSIOLOGY.

Dr. F. F. Blackman and Miss Matthæi communicated the results of their recent work on the effect of the closure of stomata on assimilation; Dr. Blackman also gave an account of his investigations on the so-called optimum strength of  $\text{CO}_2$  for assimilation.

Formation of starch from glycollic aldehyde by green plants, by Henry Jackson. Glycollic aldehyde has lately been isolated in a crystalline state, and more recently it has been shown by the author that this substance, under the influence of dilute alkalis, very quickly condenses to two synthetic hexoses. Leaves of *Tropæolum* and clover, which had been depleted of their starch by growing in the dark, were floated in a three per cent. aqueous solution of diose, control experiments being made with cane-sugar, glycerine and distilled water, the whole series being kept in the dark for six days. They were then tested by Sachs's method; those floating in pure water were quite starchless, those in glycerine almost so, but those growing in diose had accumulated starch in the tissues, though not to the same extent as those placed in cane-sugar.

On the effect of salts on the  $\text{CO}_2$  assimilation of *Ulva latissima*, L., by E. A. Newell Arber. It was found that an inhibition of the power of  $\text{CO}_2$  assimilation could be caused by the presence or absence of certain salts in the medium. *Ulva* was obtained free from starch and exposed to light in various media. In distilled water only a very small amount of starch was formed, while in tap-water containing traces of nutrient salts the inhibition was only partial. The presence of NaCl in the medium was found to be essential in order to obtain the maximum of  $\text{CO}_2$  assimilation. A total or almost total absence of NaCl caused a very marked inhibition, and no other salt could be found to replace NaCl in regard to  $\text{CO}_2$  assimilation. The absence from sea-water of any one of the following salts,

$\text{MgCl}_2$ ,  $\text{MgSO}_4$ ,  $\text{CaSO}_4$ , or KCl, did not inhibit the assimilation. The presence of a nitrate in appreciable quantity in the medium caused an inhibition.

The sea-weed *Ulva latissima* and its relation to the pollution of sea-water by sewage, by Prof. Letts and J. Hawthorn. For a number of years past a very serious nuisance has arisen from the sloblands of the upper reaches of Belfast Lough during the summer months, the stench at low-tide being quite overpowering, and the air heavily charged with sulphuretted hydrogen.

The nuisance is caused by deposits of the green sea-weed, *Ulva latissima*, which in the two localities mentioned grows in abundance, and during high winds or gales is washed ashore. In Belfast Lough the quantity thus deposited is enormous. Once deposited, these layers of sea-weed often remain more or less stationary for months in the shallow bays or pools of the neighbourhood, and in warm weather rapid putrefaction occurs, and a perfectly intolerable stench arises, which is perceptible over a wide area and seriously affects, not only the comfort of the inhabitants of the district, but also the value of their property.

The evidence which the authors have collected tends to the conclusion that the occurrence of *Ulva latissima* in quantity in a given locality is an indication of sewage contamination, and there can be no doubt as to the power which the weed possesses of absorbing nitrogen compounds from polluted sea-water. While thus acting as scavenger it may itself give rise to a very extensive nuisance.

Further investigations on the intumescences of *Hibiscus vitifolius*, L., by Elizabeth Dals. In a previous paper (*Proc. Phil. Soc. Camb.* vol. x. 1900, p. 192) the author gave the results of some experiments, which pointed to the conclusion that the conditions determining the formation of the outgrowths were moisture, warmth and light. More recent work has given the following results: (1) In a moist atmosphere, bright sunlight and a high temperature, large numbers of intumescences were formed in two or three days; (2) outgrowths were produced under red, yellow and white-washed glass, but not under blue or green glass; (3) the distribution of outgrowths is dependent upon that of the stomata; (4) the checking of transpiration in a damp atmosphere is one cause of the development of the outgrowths, but this in itself is insufficient. There is further evidence that an altered course of metabolism is also involved.

## ANATOMY, PALÆOBOTANY, &amp;c.

On a fourth type of transition from stem to root-structure occurring in certain monocotyledonous seedlings, by Ethel Sargent. Van Tieghem described three types of transition from a stem to a root-structure (*Traité de Botanique*, 1891, p. 782). Miss Sargent found a fourth type in certain monocotyledonous seedlings. The best example is *Anemarrhena asphodeloides*, but there are very clear traces of the same structure in some allied genera. In *Anemarrhena asphodeloides* there are two bundles in the cotyledon which pass downwards through the hypocotyl into the primary root. During the transition each phloem group divides into two. Each xylem group branches in three directions. It sends a group of protoxylem elements to divide its own two phloem groups from each other. Two lateral protoxylem groups are also formed from the xylem of each bundle in the space dividing the bundles from each other. The four lateral protoxylem groups thus formed are reduced to two by the fusion of adjacent groups in pairs. In the end, there are four phloem groups and four protoxylem groups in the root-stele.

On the presence of seed like organs in certain Palæozoic lycopods, by Dr. D. H. Scott, F.R.S. Specimens discovered by Messrs. Wild and Lomax in the Lower Coal-measures of Lancashire prove that the seed-like bodies described by Williamson under the name of *Cardiocarpon anomalum* were borne on strobili, agreeing with *Lepidostrobus*. Each megasporangium, which was seated on the upper surface of the sporophyll, became enclosed, when mature, in an integument springing from the tissue of the sporophyll-pedicel. The integument closed in over the top of the sporangium, leaving only a narrow crevice or micropyle, which differed in its elongated, slit-like form from the more or less tubular micropyle of an ordinary seed. Within the megasporangium four megasporopores were produced, one of which occupied almost the whole of the sporangial cavity, while the other three remained small, and were evidently abortive. The integumented megasporangium, containing the single functional megaspore or embryo-sac, became detached, together with the remains of its sporophyll, from the cone. It appears to have



been indehiscent, and presents close analogies with a true seed. In a male strobilus, probably of the same species as the specimens above described, the microsporangia were found to be provided with integuments, resembling those of the megasporangia, but more widely open.

It is proposed to give the generic name *Lepidocarpon* to this Lepidostroboid fructification.

The primary structure of certain Palæozoic stems referred to *Araucarioxylon*, by D. H. Scott, F.R.S. The Palæozoic forms of *Araucarioxylon* have been shown to belong in most cases to the stems of the extinct Gymnospermous order Cordaitæ, which was in some respects intermediate between Cycadales and Coniferae. The Cordaitæ stems hitherto investigated resemble Coniferae in the development of their wood, for the spiral first-formed tracheides are found in contact with the pith, the whole of the wood, primary as well as secondary, having thus been developed in centrifugal order. The specimens of Lower Carboniferous age now illustrated are peculiar in possessing distinct strands of primary wood in the pith. In one, *Araucarioxylon fasciculare*, sp. nov., the pith is small, but the primary strands of xylem are of large size, attaining their maximum diameter when about to pass out towards a leaf. Their structure is mesarch, and they closely resemble the corresponding strands in *Lyginodendron Oldhamium*. The secondary wood has narrow medullary rays, and resembles that of an araucarian Conifer. The other species is identical with *Araucarioxylon antiquum* of Witham. The interest of the two species (described from specimens in Mr. Kidston's collection) consists in their affording a link between certain of the Cycadofilices and the Cordaitæ.

On the structure and affinities of *Dipteris conjugata*, with notes on the geological history of the Dipteridinae, by A. C. Seward, F.R.S., and Elizabeth Dale. The genus *Dipteris* is represented by four recent species: *D. conjugata*, Reinw. [= *Polypodium (Dipteris) Horsfieldii*, R. Br.], *D. Wallichii*, R. Br., *D. Lobbiana*, Hk., and *D. quinquefurcata*, Baker. Among Mesozoic ferns the genera *Protorhipis*, *Dictyophyllum* and *Camptopteris* afford examples of extinct types closely allied to *Dipteris*, and widely spread geographically during the Jurassic epoch.

The sporangial characters of *Dipteris* do not conform precisely to those typical of the Polypodiaceæ, and the anatomical features afford additional evidence in favour of placing *Dipteris* in a special subdivision of the leptosporangiate ferns.

The paper dealt with the structure of the stem, which possesses a single annular stele, the roots, leaves and sporangia of *Dipteris conjugata*, the comparison of the anatomical features with those of the Cyatheaceæ and other ferns, and concluded with an account of the geological and geographical range of such fossil ferns as may reasonably be placed in the family Dipteridinae.

On the structure of the stem of *Angiopteris evecta*, Hoffm., by R. F. Shove, Girton College, Cambridge. This paper dealt with the anatomy of the stem and roots of a plant of *Angiopteris evecta* from Ceylon.

The steles of the stem are both mesarch and endarch in structure, but the protoxylem groups occupy for the most part a peripheral position. The earliest protoxylem appears along the inner edge of the steles, while the protophloem arises on the outer edge of each stele as a discontinuous arc of small and rather thick-walled elements. This arc of protophloem is never completed round the stele, but the next stage in the development of the tissues after the appearance of the protoxylem is the differentiation of large sieve-tubes external to the protophloem.

The conducting tissues of Bryophytes, by A. G. Tansley. The most important part of our present knowledge of these tissues is due to Haberlandt, who, in the Polytrichaceæ, distinguished a *hadrom (hydrom)* or water-conducting system from a *leptom* system, conducting plastic especially nitrogenous substances.

In the present investigation the lignified strand of prosenchyma in the thallus of certain Liverworts was shown to be a hydrom strand, and its development was considered to be correlated to some extent with the localisation of the absorptive region of the thallus.

The rhizome of four species of *Polytrichum* was investigated, and was found to possess the distribution of tissues characteristic of the root of a vascular plant. The transition to the structure of the aerial stem was followed, and some new points in the

structure and course of the leaf-traces were observed; new light was thrown also on the constitution of the Polytrichaceous stele, which is thought to consist of two regions distinct in function and by descent. An attempt was made to trace out the course of evolution of these conducting tissues in the Bryophytic series.

The origin of modern Cycads, by W. C. Worsdell. The author's conclusion is that the Cycads are descended directly from some cycado-filicinean type possessing the structure exhibited especially by such forms as the Medulloseæ and Lyginodendree, the chief point being that the *collaterally*-constructed one or more vascular cylinders of modern cycads have been derived from one or more *concentrically*-constructed cylinders of some cycado-filicinean form. Those characters in the modern plants which approximate most nearly to the primitive ancestral type are found in those parts of the plant where they would most naturally be expected, viz.:—The *axial* organs: the *primary node* or transitional region between stem and root, and the *flowering axis*; the *foliar* organs: the *cotyledon*, the *sporophyll*, and the *integument* of the sporangium. The author discussed the evidence derived from an anatomical study of recent cycads, and dealt with certain fossil types which he regarded as supporting his conclusions.

#### CYTOLOGY, &c

On the osmotic properties and their causes in the living plant and animal cell, by Prof. Overton. A very great number of experiments on the permeability of the living protoplasm of plant and animal cells has led to the conclusion that the general osmotic properties of the cell depend on a phenomenon of *elective solubility*, certain layers of the protoplasm being impregnated with a mixture of lecithin and cholesterol. All substances that are soluble in this mixture, and they include by far the greater number of organic compounds, being able to penetrate into the living cell. The rapidity of the passage of different compounds into the cell depends on their relative solubility in water and in a mixture of cholesterol and lecithin. A knowledge of the osmotic properties of the living protoplasm throws much light on the action of many poisons and other drugs.

Demonstration of the structure and attachment of the flagellum in *Euglena viridis*, by Harold Wager. The flagellum of *Euglena viridis* possesses a bifurcate base, which is attached to the wall of the excretory reservoir at the anterior end of the body (*Journ. Linn. Soc. Zool.* vol. xxvii. p. 463). As it passes to the exterior through the gullet, an enlargement occurs in the region of the eye-spot. This structure can be seen in very favourable cases in the living condition, but usually only after the action of reagents. The best reagents for this purpose are either a 1 per cent. solution of osmic acid or a 2 per cent. solution of bichromate of potash with a 1 per cent. solution of osmic acid. The structure may be obscured by small grains of paramylon, which sometimes accumulate at the anterior end of the body.

The behaviour of the nucleolus during karyokinesis in the root-apex of *Phaseolus*, by Harold Wager. From a study of the changes undergone by the nucleolus during karyokinesis in cells of the root-apex of *Phaseolus multiflorus*, the following chief results have been obtained.

(1) The nucleolus is the most conspicuous object in the nucleus of the young meristematic cells. The nuclear network forms a delicate peripheral layer only in the resting nucleus. (2) The nucleolus stains deeply in hæmatoxylin, the nuclear network slightly; in safranin and gentian violet the nucleolus stains red, the nuclear network light blue. (3) In the resting condition of the nucleus the nucleolus is suspended to the nuclear network by delicate filaments. (4) The nucleolus often shows a vacuolar structure. (5) In the process of nuclear division the nucleolus first of all becomes irregular in shape, and the nucleolar substance appears to pass, by means of the connecting strands, into the nuclear network, which thereby becomes more prominent. (6) As the chromosomes are formed the nucleolus disappears, but a portion of the nucleolus is often visible in the equatorial plate. (7) The chromatic substance of the chromosomes appears to be derived almost entirely from the nucleolus. (8) As the daughter-nuclei are being formed the chromatic substance of the chromosomes runs together into small spheres, which ultimately fuse to form the single large nucleolus.

On double fertilisation in a dicotyledon, *Caltha palustris*, by Ethel N. Thomas. The polar nuclei of this plant unite before fertilisation, but that there is no absolutely fixed period is shown

by the very different appearance of sacs in which polar fusion is taking place. The male generative nuclei, when first set free in the embryo-sac, are extremely small and heavily stained. Their chromatic substance is so densely aggregated as to render the spermatozoid to all appearance homogeneous. Of the two spermatozooids one passes to the middle of the sac and there fertilises the definitive nucleus; the other fertilises the nucleus of the oosphere. By the time the male generative nucleus or spermatozoid has reached the definitive nucleus, it has enlarged immensely, and shows a light spongy structure with scattered chromatin granules. The other spermatozoid increases very little in size, and always remains dark and dense.

When the spermatozooids leave the pollen-tube they are somewhat short and thick, and only slightly curved, but when the one has approached the definitive nucleus, it has the typical vermiform shape, with one or several coils.

#### THALLOPHYTES.

Germination of the zoospore in Laminariaceae, by J. Lloyd Williams. The zoospore comes to rest and becomes spherical. The single chloroplast divides in two. A tube is produced, the spore-contents pass into it. At the end of the tube a swelling is formed, into which the contents migrate and are shut off from the empty spore-case and tube by a wall. This has been wrongly described by Areschoug in the case of *Dictyosiphon* as an instance of sexual fusion. In the enlargement, the chloroplasts multiply, and additional eyespots appear on several, which, however, disappear after a few days. The newly-separated cell now divides, and forms a branched protonema-like structure.

Notes on *Dictyota*, by J. Lloyd Williams. The factors concerned in the production of the fortnightly crops of sexual cells were discussed. Experiments on the liberation of antherozoids show the importance of bright light and cool temperature. *Dictyota* is particularly responsive to changes in the environment.

The nuclear changes in the unfertilised eggs are peculiar. The chromosomes are differentiated, a very irregular multipolar spindle is formed; this separates into a number of nuclei of various sizes, in which at first the chromosomes are scattered. These soon disappear, the nucleoli are formed, and the nuclei appear in the resting condition.

The Azygospores of *Entomophthora gloeospora*, by Prof. Vuillemin (Nancy) (communicated by Prof. Hartog). The genus *Entomophthora*, as seen in the two species *E. Delphiniana* and *E. gloeospora*, shows an intermediate condition between *Basidiobolus*, with its uninucleated segments, and *Empusa*, with its continuous hyphae with scattered nuclei. The resting-spores of *Entomophthora* may be terminal, lateral or intercalary. The youngest spores contain a single nucleus, which undergoes a series of four successive binary divisions until there are sixteen; there may, however, be irregularities as regards the number of spores. In the next stage the nuclei approach so as to form eight pairs, and the two nuclei of each pair then fuse; this fusion is repeated until there are only two left. These last two may then fuse at once, so as to leave the now maturing azygospore with a single nucleus, or they may remain apart. This manner of development is interpreted as a case of true apogamy, and regarded as corresponding to the sexual process in *Basidiobolus*.

Fungi found in Ceylon growing upon scale-insects (*Coccidae* and *Aleurodidae*), by J. Parkin. Fungi associated with scale-insects have till recently been little studied. A few species have been mentioned from time to time as growing upon scales of dead coccids, but, till within the last few years, hardly any attention has been called to their probable parasitic character, or to the possibility of their being employed to check the ravages of scale-pests. Webber in 1897 pointed out for the first time the parasitic habit of certain species—five in all—of *Aschersonia* on scale-insects infesting the orange and other plants in Florida. Zimmermann (Java) in the following year gave a preliminary account of a fungus (*Cephalosporium*) attacking the green bug (*Lecanium viride*), so harmful to the coffee, and described how it may be artificially cultivated for infecting experiments.

The various kinds dealt with were referred to the following genera:—*Nectria*, *Torrubiella*, *Aschersonia*, *Cephalosporium*, *Verticillium*, *Microcera*, *Campotrachium* (?).

Mr. Parkin drew attention to the wide distribution, especially in and near the tropics, of fungi infecting scale-insects, and referred to them as the true cause of death of the insects. The

paper was illustrated by a series of carefully-prepared specimens and drawings.

On the life-history of *Acrospeira mirabilis* (Berk. and Br.), by R. H. Biffen. Loose brown masses of the spores of this fungus are occasionally found in Spanish chestnuts. These spores are developed from the apices of hyphae coiled into a spiral of, at the most, two turns, which becomes septate into three cells; the cell next below the apical one swells and becomes thick-walled, thus forming a chlamydospore. The coiled hypha may also develop into a spiral resembling the ascogonium of *Eurotium*, which, after investment by branches arising from its apex, breaks down into chlamydospores. In this way bodies very suggestive of the spore-masses of some of the Ustilaginæ are formed. Endoconidia are found in old cultures. Some evidence has also been obtained for the existence of an ascigerous stage.

On the structure of the root-nodules of *Alnus glutinosa*, by T. W. Woodhead. The nodules are traversed by a central strand of short, thick-walled fibres, with transverse pits in the walls. Surrounding this are 4-5 layers of cubical cells, rich in protoplasm, followed by a small-celled bulky cortex. On the outside of this is a phellogen, which produces a layer of cork several cells deep. The cortical cells are largely occupied by the organism which produces the nodule.

The organism is usually present as a globular sporangium at the end of a short hypha. Towards the base of the nodule are strands of cells occupied by disorganised contents indicating a previous tract of growth of the organism: this is succeeded by groups of cells filled with the organism in various stages. Towards the apex, and immediately behind the growing-point, the cells containing the sporangia are immediately followed by cells filled with fine hyphal filaments, which may be seen to penetrate the walls of the young adjacent cells.

A Gymnosporangium from China, by Prof. F. E. Weiss. This fungus was first observed by Dr. A. G. Parrott in the spring of 1899 in Lao-ho-kou, in North Central China. Its spore masses made their appearance in April after a few days' continuous rain on the branches of *Juniperus chinensis* in the form of bright yellow, gelatinous masses. The teleutospores are of the usual type, two-celled, tapering towards both ends and somewhat rounded at the apex. They possess eight germ-pores. What is in all probability the *Roestelia* stage of this fungus was observed during the summer on the leaves of the pear, *Pyrus sinensis*, Ldl. A tree of this species growing in proximity to the infected junipers was attacked by a fungus of the *Roestelia* type, producing typical æcidiospores.

In the appearance of its teleutospore masses this fungus appears most nearly related to *Gymnosporangium Sabinae* (Dicks), a widely distributed form occurring in Europe and in America, and to *Gymnosporangium Cunninghamianum* (Barclay), a Himalayan form, both of which have their *Roestelia* stage on a pear.

The biology and cytology of *Pythium*, by Prof. Trow. The species described by the author was cultivated from conidia and oospores found in rotten cress seedlings. The study of pure cultures led to the following among other conclusions:—(1) No zoospores are produced under any circumstances. (2) The species is new and ranks as the most highly developed of the genus. (3) The fertilisation-tube penetrates the wall of the oogonium at a spot prepared for it, passes through the periplasm and penetrates deeply into the egg. One male nucleus passes down the tube and enters the egg. The oosphere clothes itself with a delicate wall and increases in size. (4) The fusion of the male and female nuclei is delayed until a thick oospore wall has been developed. (5) The nuclei multiply by indirect division in the mycelium and sexual organs. The only nuclear fusion is that of the male and female nuclei in fertilisation.

Observations on *Pythium*, by M. Poirault and E. J. Butler. The authors examined seven species, two of which were undescribed forms. In two species, *Pythium gracile* and *P. intermedium*, sexual organs were observed for the first time. Klebs' results on the dependence of spore-formation in *Saprolegnia* on external conditions were carried a step further, it being shown that a given spore could be induced to develop zoospores or vegetative hyphae on appropriate treatment. The authors conclude that *Pythium* represents a stage in the colonisation of the land, by saprolegniaceous ancestors resembling *Aphanomyces*. It is closely linked to the *Peronosporaceae* through *Pythium intermedium*, which possesses chains of gonidia, suckers, and a thick-walled mycelium.



Observations on some Chytridinae, by M. Poirault and E. J. Butler. Four undescribed forms occur parasitic on *Pythium*. Their life-history has been worked out by the authors. *Chytridium gregarium* was found on the eggs of the rotifer *Metopidia Lepadella*; the unknown resting-spores were discovered. Observations were made on *Olpidiopsis Saprolegniae*. The infection takes place in the zoospore-stage of *Saprolegnia*, and is often multiple. Penetration takes place by a fine tube, through which the protoplasm of the parasitic zoospore enters the host, leaving behind an empty capsule. A. C. S.

### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The following lectures are announced for the present term : Prof. R. B. Clifton, Acoustics ; J. Walker, Double refraction ; R. E. Baynes, Elementary mechanics of solids and fluids, and Mathematical theory of heat ; Prof. W. Odling, Organic chemistry, metallic bodies ; W. W. Fisher, Inorganic chemistry (preliminary course) ; J. Watts, Organic chemistry (honours course) ; V. H. Veley, Physical chemistry ; J. E. Marsh, Stereochemistry ; A. G. Vernon-Harcourt, The subjects of the preliminary examination (chemistry) ; P. Elford, Mendeleëff's periodic system. Introduction and group I ; P. Elford, Chemists and their work ; A. F. Walden, Origin, meaning and use of chemical symbols, formulæ and equations (elementary course) ; Prof. W. J. Sollas, Physical geography ; Prof. W. J. Sollas, Jurassic fossils ; Prof. H. A. Miers, Elementary crystallography ; H. L. Bowman, The metallic minerals ; Prof. W. F. R. Weldon, General course of morphology (Coelentera) ; J. W. Jenkinson, Elementary morphology ; E. S. Goodrich, Morphology of fishes ; R. W. T. Günther, Polyzoa and brachiopoda ; J. B. Thompson, Morphology of the ichthyopoda ; J. B. Thompson, Ichthyopsidan palæontology ; Prof. F. Gotch, General course of physiology, Part I. chemical processes ; Prof. F. Gotch, Advanced course on muscle ; J. S. Haldane, Subjects of the final honour school (physiology) ; G. Mann, Histology : G. J. Burch, Physiological physics ; W. Ramsden, Introduction to physiological chemistry ; G. Mann, Practical histology ; W. Ramsden, Elementary physiological chemistry ; Prof. S. H. Vines, Short elementary course (revision) with practical work ; Prof. E. B. Tylor, Development of language, writing, arithmetic ; H. J. Mackinder, The historical geography of the British Islands ; H. J. Mackinder, The development of geographical ideas ; H. N. Dickinson, The atmospheric circulation ; A. J. Herbertson, The geographic cycle ; Sir J. Burdon-Sanderson, General pathology ; Prof. A. Thomson, Anatomy of the nervous system ; Prof. H. H. Turner, Elementary mathematical astronomy ; Prof. A. E. H. Love, Gravitational attraction, and theory of the potential ; and the theory of sound ; Prof. E. B. Elliott, Theory of numbers ; and substitutions and resolvents ; Rev. F. J. Jervis-Smith, Dynamo and motor machinery and electrical testing ; G. F. Stout, Child psychology ; and the psychological development of the categories of subject, cause and end.

The electors to the newly instituted Wykeham Professorship of Physics will proceed to an election in November. Candidates are requested to send in their applications by October 24. The electoral body consists of the following :—The President of the Royal Society, Sir George Stokes, Prof. Esson, Prof. Odling, Mr. Hayes.

The Rev. E. C. Spicer, of New College, has been elected to the University Scholarship recently instituted in connection with the new School of Geography.

CAMBRIDGE.—The following is the speech delivered on October 11, by the Public Orator, Dr. Sandys, in presenting for the degree of Doctor in Science, *honoris causa*, Mr. Samuel Pierpont Langley, Keeper of the National Museum, Secretary of the Smithsonian Institution, and Director of the Astrophysical Observatory in Washington ; the inventor of the "bolometer" and the "aerodrome."

Trans aequor Atlanticum ad nos nuper advectus est vir scientiarum in provincia insignis, qui etiam de astronomia recentiore librum pulcherrimum conscripsit. In urbe quod reipublicae maximae transmarinae caput est, viri huiusce curae multa mandata sunt : primum museum maximum rerum naturae spoliis quam plurimis ornatum ; deinde institutum celeberrimum scientiae et augendae et divulgandae destinatum ; denique arx et specula quaedam stellarum lumini in partes suas distribuendo

dedicata. Luminis in spectro, ut aiunt, infra radios rubros radii alii qui oculorum aciem prorsus effugiunt, viri huiusce ingenio, instrumenti novi auxilio quod *βολόμετρον* nominavit, paulatim proditi et patefacti sunt. Nemo mirabitur virum stellarum observandarum amore tanto affectum, etiam e terra volandi desiderio ingenti esse commotum,—adeo ut, quasi alis novis adhibitis, plus quam trium milium pedum per spatium, etiam avium volatum aemulari potuerit. Fortasse aliquando, Icarum sortem non veritus, etiam Horati praesagia illa sibi ipsi vindicabit :—

"non usitata nec tenui ferar  
penna biformis per liquidum aethera."

Fortasse rerum terrestrium impatiens, rerum caelestium avidus, ausus erit e terris "volare  
sideris in numerum, atque alto succedere caelo."

THE Senate of the reorganised University of London is now complete, and is constituted as follows :—Chancellor—The Right Hon. the Earl of Kimberley. Vice-Chancellor—Sir H. E. Roscoe, F.R.S. Chairman of Convocation—Edward Henry Busk. *Crown Members*—The Hon. W. Pember Reeves, Sir H. E. Roscoe, F.R.S., Mrs. E. M. Sidgwick, Sir John Wolfe Wolfe-Barry, F.R.S. *Faculty Members*—Theology—The Rev. Principal Alfred Cave. Arts—Prof. M. J. M. Hill, F.R.S., Prof. W. Paton Ker, Miss Emily Penrose, Prof. G. C. Warr. Laws—Lord Davey, appointed by the Crown. Music—Sir Charles Hubert Hastings Parry. Medicine—Dr. J. R. Bradford, F.R.S., Dr. J. Kingston Fowler, Dr. E. C. Perry. Science—Sir Michael Foster, Sec. R.S., Dr. William D. Halliburton, F.R.S., Prof. William Ramsay, F.R.S., Prof. A. W. Rücker, F.R.S. Engineering—Prof. W. C. Unwin, F.R.S. Economics, &c.—Prof. W. A. S. Hewins. Royal College of Physicians—Dr. W. H. Allchin, Dr. P. H. Pye-Smith, F.R.S. Royal College of Surgeons—Dr. A. P. Gould, Dr. H. G. Howse. University College—Prof. G. C. Foster, F.R.S., Lord Reay. King's College—Lord Lister, P.R.S., the Rev. Principal A. Robertson, D.D. Lincoln's Inn—Lord Macnaghten. Inner Temple—Judge Sir Alfred Marten, Q.C. Middle Temple—Mr. C. M. Warmington, Q.C. Gray's Inn—Mr. C. A. Russell, Q.C. Incorporated Law Society—Mr. W. Godden, Mr. R. Pennington. Corporation of London—Dr. T. B. Crosby. London County Council—Dr. W. J. Collins, Mr. Sidney Webb. City and Guilds of London Institute—Sir Frederic Abel. *Convocation Members*—Arts—Dr. J. Bourne Benson, Dr. J. D. McClure, Dr. T. Lambert Mears, Mr. J. Fletcher Moulton, M.P., F.R.S., Dr. T. B. Napier, Sir A. K. Rollet, M.P. Laws—Mr. Justice Cozens-Hardy. Music—Mr. J. W. Sidesbotham. Medicine—Dr. Thomas Barlow, Dr. J. F. Payne. Science—Mrs. Sophia Bryant, Prof. Frank Clowes, Dr. C. W. Kimmins, Dr. F. S. McAulay, Sir Philip Magnus, Prof. Silvanus Thompson, F.R.S.

THE installation of the Earl of Rosebery as Lord Rector of Glasgow University has been fixed to take place on November 16.

PROF. BRUNHES, professor of physics in the University of Dijon, has been appointed director of the observatory on the Puy-de-Dôme.

MR. HOLBROOK GASKELL has given 1000*l.* towards the building and equipment of a new physics laboratory for University College, Liverpool.

MAJOR R. H. FIRTH has been selected to succeed Colonel J. Lane Nottor, R.A.M.C., as professor of Military Hygiene at the Army Military School, Netley.

A FELLOWSHIP of the annual value of 100*l.*, for three years, will be awarded at Newnham College, Cambridge, in June 1901. Applications from former students of the college should be sent by May 1 to the Principal, from whom further information may be obtained.

THE Essex Museum of Natural History will be opened at West Ham this evening (October 18) by the Countess of Warwick ; and the Municipal Technical Institute, which was destroyed by fire a few months ago, will be reopened by Mr. J. Passmore Edwards.

MR. T. GRAHAM YOUNG, son of the late Dr. James Young, F.R.S., has offered the sum of 10,000*l.* to the West of Scotland Technical College Building Fund, provided that certain conditions are fulfilled as to the site of the new College, the construction of a chemical department, and the completion of the building within five years of next January.